
Name of Organization: Indiana Dunes National Lakeshore

Type of Organization: Federal Agency

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Resource Management

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Project Title: Pannes: Invasion Windows and Applications to Management

Project Category: Exotic Species

Rank by Organization (if applicable): 0

Total Funding Requested (\$): 83,360 **Project Duration:** 2 Years

Abstract:

Pannes are unique dunal wetlands that, as defined by Chicago Wilderness Biodiversity recovery plan, occur within one mile of the shoreline of Lake Michigan. They are considered a globally imperiled community by the Nature Conservancy and have been placed on the second tier of conservation targets for recovery by the Chicago Wilderness Biodiversity recovery plan. Pannes are scattered along the eastern and southern dune system of Lake Michigan from Chicago to northern lower Michigan.

Urbanization has exposed protected natural systems, such as pannes, to many anthropogenic stressors as well as biological stressors such as propagule pollution. Those responsible for maintaining the integrity of natural areas must either commit more resources to manage them or manage natural areas in smarter, more efficient ways. Managing natural areas for exotic species in smarter more efficient ways requires knowledge of ecosystem resistance to invasion, propagule pressure and properties of the invasive and non-invasive species.

We will conduct studies to determine which panne micro-habitats and environmental conditions are sensitive to exotic species dispersal and establishment. We will determine the preferred edaphic, topographic, hydrologic and plant community positions for exotic establishment and how seasonal and annual groundwater fluctuations change the suitable invasion habitat in time. A second series of studies will investigate how invasive species alter the panne's edaphic and hydrological environment and the effect of the modifications on colonization by panne species following removal of the exotic population.

Products include panne restoration and written documents. The written documents will be made available to the public through publications in scientific journals and a design manual for management and restoration of pannes. Several hundred copies of the design manual will be printed and made available to resource managers.

Geographic Areas Affected by the Project

States:

- | | |
|--|--|
| <input type="checkbox"/> Illinois | <input type="checkbox"/> New York |
| <input checked="" type="checkbox"/> Indiana | <input type="checkbox"/> Pennsylvania |
| <input checked="" type="checkbox"/> Michigan | <input type="checkbox"/> Wisconsin |
| <input type="checkbox"/> Minnesota | <input checked="" type="checkbox"/> Ohio |

Lakes:

- | | |
|--|------------------------------------|
| <input checked="" type="checkbox"/> Superior | <input type="checkbox"/> Erie |
| <input checked="" type="checkbox"/> Huron | <input type="checkbox"/> Ontario |
| <input checked="" type="checkbox"/> Michigan | <input type="checkbox"/> All Lakes |

Geographic Initiatives:

- | | | | | |
|--|----------------------------------|--|--------------------------------------|---|
| <input type="checkbox"/> Greater Chicago | <input type="checkbox"/> NE Ohio | <input checked="" type="checkbox"/> NW Indiana | <input type="checkbox"/> SE Michigan | <input type="checkbox"/> Lake St. Clair |
|--|----------------------------------|--|--------------------------------------|---|

Primary Affected Area of Concern: Grand Calumet River/IHC, IN

Other Affected Areas of Concern:

For Habitat Projects Only:

Primary Affected Biodiversity Investment Area: Not Applicable

Other Affected Biodiversity Investment Areas:

Problem Statement:

Pannes are unique dunal wetlands that, as defined by Chicago Wilderness Biodiversity recovery plan, occur within one mile of the shoreline. They are considered a globally imperiled community by the Nature Conservancy and have been placed on the second tier of conservation targets for recovery by the Chicago Wilderness Biodiversity recovery plan. Pannes are scattered along the eastern and southern dune system of Lake Michigan from Chicago to northern lower Michigan, along the southern shore of Lake Huron and in one known location on Lake Superior. Within the Chicago Wilderness area, the locations of no more than 15 pannes are known.

Retaining the biological integrity of pannes is important because they provide habitat for many restricted plants as well as sensitive amphibian and reptile species. Pannes are small but species rich. A floristic survey of 11 pannes at the Indiana Dunes National Lakeshore, revealed 32 to 78 species per panne with an average of 50 species per panne. Fourteen Indiana state listed plant species were reported present in the pannes.

Invasive species were present in all pannes. Invasive species observed in the pannes were *Phragmites australis* (Common reed), *Phalaris arundinaceae* (Reed canary grass), *Typha* spp. (Cattail), *Lythrum salicaria* (Purple loosestrife) and *Salsola kali* (Russian thistle). In 50 percent of the pannes, exotic species were sufficiently dense to have a notable negative impact on native panne vegetation. In one panne, populations of three state listed species present and monitored in permanent plots in the 1980's were extinct, their habitat now occupied by *P. australis*, *Typha* spp. and *L. salicaria*.

At the urban core, historically species rich native assemblages have succumbed to invasive species such as *Typha* spp., *L. salicaria* and *P. australis*. Urbanization has exposed protected natural systems to many anthropogenic stressors as well as biological stressors such as propagule pollution. Therefore, those responsible for maintaining the integrity of natural areas must either commit more resources to manage them or manage natural areas in smarter, more efficient ways.

Smarter and more efficient management of invasive exotic species requires knowledge of ecosystem resistance to invasion, propagule pressure and properties of invasive species as well as those species being replaced. Knowledge of the invasion process in pannes will allow managers to pinpoint conditions affecting invasibility, for example water levels, season of year, occurrence of anthropogenic stressors, and that part of the panne most vulnerable to invasion. This knowledge will reduce unproductive person-hours evaluating pannes when invasion windows are closed. When invasion windows are open, pannes would be managed more efficiently because resource managers would know which portions of the panne are most susceptible to invasion.

In many pannes, populations of invasive exotic species have established and continue to spread. Restoration of the

biological integrity of these pannes is a two step process. In step one the exotic population must be removed and in step two replaced with native panne species. The invasive exotic population may modify the physical, chemical and biological properties of the panne's substrate rendering it less favorable to colonization by native panne species.

The scientific literature provides little assistance in fine tuning management activities in pannes. Under what conditions panne invasibility increases or decreases is not known. The role of propagule pollution has not been investigated. Variation of invasibility within the panne is not known. In addition, after the invasive population is established, the process by which it is removed and replaced with native panne vegetation is not understood.

We are proposing studies to determine which panne micro-habitats and environmental conditions are sensitive to exotic species dispersal and establishment. We hypothesize that establishment of exotics is limited to specific topographic, hydrologic, edaphic and plant community positions, but that seasonal and annual groundwater fluctuation will change the proportion of suitable invasion habitat in time. A second series of studies will examine how exotic invasives alter the panne's edaphic and hydrologic environment and the consequences of the modifications to colonization by panne species.

Proposed Work Outcome:

Two sets of studies will be conducted. One set of studies will investigate the relationship between invasion windows and micro-habitat variation and the dependence of these relationships on the spatial configuration of pannes in the dunal landscape and time factors. The other set of studies will examine how exotics alter the panne's edaphic and hydrologic environment and the effects of the modifications on colonization by panne species.

Invasion Windows:

Six to nine pannes at the Miller and West beach units of Indiana Dunes National Lakeshore and one panne owned by the Indiana Department of Natural Resources, Division of Nature Preserves, Clark and Pine East, will be studied. In this latter panne will be included pending permission of the Indiana Department of Natural Resources. The pannes will be selected in the landscape to realize a gradient of distance and exposure to known sources of invasive seeds. Distances to known exotic sources, cultural landscapes and human activity will be calculated from a GIS analysis of data. These data will parameterize the relationship between proximity and the seed rain

The realized flora will be evaluated using standard vegetation analysis methods. The vegetation will be evaluated in 1X1meter quadrats. A species list will be compiled and dominance of them determined using cover estimates. These data will be correlated with physical environmental characteristics, such as soil chemistry, topographic relief and hydrology.

The potential flora will be evaluated by seedbank sampling and examining the seed rain using seed traps. The seedbank will be evaluated by the seedling assay method. Approximately 15 sample points per panne will be evaluated. At each sample point, 15 soil cores will be extracted using a golf hole cutter. The cores will be homogenized and 6 subsamples selected. Three subsamples will be exposed to saturated conditions and three subsamples to inundation by approximately 10 cm of water.

Seed traps will provide data on the potential flora and propagule pressure of exotics. The seed traps will be randomly positioned throughout the panne. Weekly, the traps will be inspected, the seed identified to species and quantified.

Panne surface and ground water levels will be determined. A net work of staff gauges, monitoring wells and piezometers will be established in each panne. In each panne, 15 soil cores will be taken and analyzed for their chemistry. Soils will be sampled to a depth of 15cm and the following chemical characteristics determined: total nitrogen, ammonium, nitrate, available phosphorus, pH, exchangeable potassium, exchangeable magnesium, exchangeable calcium, exchangeable hydrogen, cation exchange capacity, base saturation, sodium, carbon and organic matter. In addition, a subsample of 50 soil cores will be extracted and described using standard soil taxonomic methods.

Weekly each panne will be inspected for germinating exotics. When found, the position of the exotic will be noted and the seedling marked. Marked exotics will be observed weekly and their survival or death recorded.

Colonization Studies:

In the second set of studies several pannes that have established populations of exotics will be studied. The position of invasive exotic populations within the panne will be surveyed. The physical and biological parameters associated with the invasive population, such as water depth, topography and soil chemistry will be determined. The Invasive populations will be treated with herbicides and then portions of the substrate exposed to an experimental seed rain of native panne species. revegetation patterns of areas exposed to the experimental seed rain and areas not exposed to the seed rain will be monitored. Investigations into physical and biological parameters will be conducted using the same methodology as given under invasion windows.

Products:

Invasibility of a plant community can be derived from the residuals from the relationship between invasion success, i.e. establishment of an invader, and propaule pressure i.e. the seed rain. The proposed studies will quantify propagule pressure and invader establishment and relate these data to panne micro-habitats, environmental conditions and landscape spatial configurations. The analyses will identify invasion windows and allow for development of best management techniques.

Exotics may alter panne edaphic and hydrological environment. These modifications may influence colonization of the panne by native panne species. The second set of studies will document exotic induced alterations and the impacts of them on colonization by panne species.

The information will be distributed via publications in scientific journals and development of a design manual for management and restoration of pannes. Scientific journals that publish restoration subject matter such as Restoration Ecology, Wetlands and Natural Areas, will be targeted. Several hundred copies of the design manual will be printed and made available to interested restorationist in the Great Lake area.

In addition to written products, Management activities associated with the study will initiate destabilization of some invasive populations currently present in the pannes and the replacement of them by native panne species.

| Project Milestones: | Dates: |
|---------------------------------------|---------------|
| Project Start | 10/2000 |
| Seedbank sampling completed | 05/2001 |
| Soil and Vegetation survey completed | 10/2001 |
| Habitat modification study completed | 09/2002 |
| Seedrain/invader est. study completed | 10/2002 |
| Data entry completed | 11/2002 |
| Draft report(design manual) | 01/2002 |
| Project End- Final product | 03/2003 |

Project Addresses Environmental Justice

If So, Description of How:

Project Addresses Education/Outreach

If So, Description of How:

Work on factors contributing to invasives in pannes provides an excellent opportunity to educate Indiana Dunes National Lakeshore visitors about biodiversity and the threat of invasives to it. The interest of the typical visitor to the West Beach Unit, where several of the study sites exist, is use of the beach area. The presence of several pannes on the access trail to the beach provides an educational and outreach opportunity. Funding from local supporters, such as Friends of the Dunes, Save the Dunes and Shirley Heinze Fund, will be sought for signage and interpretive materials. These materials will be used to inform beach users of the contribution pannes provide to the biodiversity of the Great Lakes. Also, information concerning biological pollutants and the damage they pose to Great Lake biodiversity will be provided.

The Indiana Dunes National Lakeshore's interpretation staff will be invited for visits to observe this effort to understand how and why pannes are invaded by exotic species. The interpretive staff will be able to pass on the information to park visitors. Park visitors may not be aware of the important contribution pannes provide to the biodiversity of the Great Lake and the threat that invasives pose to that biodiversity.

Project Budget:

| | Federal Share Requested (\$) | Applicant's Share (\$) |
|----------------------------|-------------------------------------|-------------------------------|
| Personnel: | 22,800 | 24,000 |
| Fringe: | 1,710 | 7,200 |
| Travel: | 1,500 | 0 |
| Equipment: | 750 | 0 |
| Supplies: | 4,500 | 0 |
| Contracts: | 48,000 | 0 |
| Construction: | 0 | 0 |
| Other: | 4,100 | 0 |
| Total Direct Costs: | 83,360 | 31,200 |
| Indirect Costs: | 0 | 0 |
| Total: | 83,360 | 31,200 |
| Projected Income: | 0 | 0 |

Funding by Other Organizations (Names, Amounts, Description of Commitments):

There exists two firm commitments of other funding. The project is a collaborative effort among the United States Geological Survey (USGS), The Nature Conservancy and the National Park Service (collaboration). The USGS will contribute approximately \$20,000 of personnel time (Dr. Noel Pavlovic). The Nature Conservancy will contribute approximately \$10,000 of personnel time (Mr. Paul Labus). The total contribution of collaborators is approximately \$61,200.

The seedbank shelters will be constructed through the donated time of Boy Scouts. The government estimates volunteer time at approximately \$13.00 per hour. Construction of the seedbank shelters will require approximately 150 hours. Therefore, volunteer contributions in this effort is approximately \$1,950.00

National Park Service volunteer, Gayle Tonkovich, has donated approximately 50 hours conducting floristic surveys of the pannes. If the proposal is funded, Ms tonkovich has expressed an interested in volunteering approximately 100 hours per season. The value of her contribution would be \$2,600.00.

A few of the pannes intended for study will be located in the West Beach unit and are visible to park visitors. Funding from local supporters, for example Friends of the Dunes, Save the Dunes, Shirley Heinze Fund, will be sought for signage and interpretive materials. These materials will be used to educate park users concerning the contribution pannes provide to the biodiversity of the Great Lakes.

Description of Collaboration/Community Based Support:

As indicated under "Other Sources of Funding" the project will be a collaborative effort involving the National Park Service, United States Geological Survey and the Nature Conservancy.

The National Park Service at Indiana Dunes National Lakeshore has a long standing relationship with youth organizations such as the Boy Scouts and an aggressive program to recruit volunteers from the local community. While there is no firm commitment, there have been several inquiries from the Boy Scout organization for projects such as building of seedbank germination shelters.